

REMARKS

Summary

By this Amendment, Claims 1, 27, 33, 34, 35 and 37 have been revised, and accordingly, Claims 1-38 remain pending in the application.

35 U.S.C. ¶102 and ¶103 – Okano et al.

Claims 1-25 were rejected under 35 U.S.C. ¶102 and ¶103 as being unpatentable over Okano et al. (US 4529475) for the reasons states at pages 2-4 of the Office Action.

By this Amendment, independent Claim 1 has been revised to more clearly define over the Okano et al. reference. In particular, as recited in amended Claim 1, the present invention is partially characterized by repeatedly performing an etching process cycle, wherein each etching process cycle increases a depth of an etched feature in the material or film. Each etching process cycle includes etching the material or film to increase the depth of the etched feature, depositing or forming a passivation layer on the surfaces of the etched feature, and partially removing the passivation layer from the surfaces of the etched feature in order that the etching of subsequent etching process cycles proceeds in a direction substantially perpendicular to the material or film surface.

The amended Claim 1 clearly defines over the “step-and-repeat” type etching process referred to in Okano et al. This process of Okano et al. includes stepwise (X and Y directions) movement of the vertical beam 60 relative to the workpiece 10 after etch etching process. Okano et al. does not teach repeatedly performing a same etching process cycle such that a depth of an etched feature is increased by each process cycle.

For at least the reasons stated above, Applicants respectfully contend that Claims 1-25 are neither anticipated by, nor obvious in view of, the teachings of Okano et al.

35 U.S.C. ¶103 – Laermer et al. in view of the Admitted Prior Art

Claims 1-10 and 14-25 were rejected under 35 U.S.C. ¶103 as being unpatentable over Laermer et al. (US 5501893) in view of the admitted prior art for the reasons states at pages 4-5 of the Office Action.

Applicants respectfully contend that the amended independent Claim 1 defines over the teachings of Laermer et al., taken alone or in combination with the admitted prior art. That is, according to the presently claimed invention, each of the etching processing cycles includes a step for etching the substrate, a step for depositing a passivation layer, and a step for partially removing the passivation from the etched feature. In contrast, Laermer et al. is directed to two-step process

cycles of etching and passivation. The partial re-stripping of the passivation layer occurs during etching in the next subsequent cycle. Col. 4, lines 38-44. Laermer et al. does not teach a step of partially removing the passivation layer within each etching process cycle.

Also, Applicants respectfully disagree with the Examiner's contention that it would be obvious to modify Laermer et al. so as to conduct non-plasma etching. Laermer et al. specifically teaches that the polymer layer is rapidly broken through during subsequent etching because the polymer is stripped very quickly with "the ion support." Col. 4, lines 54-57.

For at least the reasons stated above, Applicants respectfully contend that Claims 1-10 and 14-25 are not obvious in view of the teachings of Laermer et al., taken alone or in combination with the admitted prior art.

35 U.S.C. ¶103 – *Laermer et al.*

Claims 27-33 were rejected under 35 U.S.C. ¶103 as being unpatentable over Laermer et al. (US 5501893) for the reasons states at pages 5-6 of the Office Action.

By this Amendment, Claim 27 has been revised in a manner similar to the above-discussed revisions to Claim 1. Accordingly, for at least the same reasons stated above in connection with the rejection of Claim 1-10 and 14-25 in view of

Laermer et al. and the admitted prior art, Applicants respectfully contend that Claims 27-33 are not obvious in view of Laermer et al.

35 U.S.C. ¶102 – *Seaver et al.*

Claims 37-38 were rejected under 35 U.S.C. ¶102 as being unpatentable over Seaver et al. (US 4748043) for the reasons states at page 3 of the Office Action.

By this Amendment, Claim 37 has been revised to more clearly define over the configuration of Seaver et al. That is, the vapour delivering apparatus of Claim 37 includes a dielectric plate having a plurality of apertures extending therethrough from a back side of the dielectric plate to a front side of the dielectric plate, and a continuous metallic layer covering the back side of the dielectric plate and side walls of the plurality of apertures and terminating through each aperture at the front side of the plate. The plurality of apertures having the sidewalls covered by the metallic layer define a respective plurality of nozzles.

For at least the reasons that Seaver et al. fails to teach or suggest a continuous metallic layer which covers the back side of a dielectric plate and side walls of a plurality of apertures, and which terminates through each aperture at the front side of the plate, Applicants respectfully contend that Claims 37 and 38 are neither anticipated by, nor obvious in view of, the teachings of Seaver et al.

35 U.S.C. ¶103 – *Seaver et al.*

Claims 34-36 were rejected under 35 U.S.C. ¶103 as being unpatentable over Seaver et al. (US 4748043) for the reasons states at page 6 of the Office Action.

By this Amendment, Claim 34 has been revised to expressly state that the droplets attracted towards the substrate are etching solution droplets.

Applicants respectfully disagree with the Examiner apparent contention that it would be obvious to use the “dispensing and coating heads” of Seaver et al. as a means to supply an etching solution during an etching process. Seaver et al. does not mention etching, and there is not suggestion in Seaver et al. that the coating head thereof would be suitable for use in a chambered etching environment. In fact, the primary coating process described by Seaver et al. is directed to the coating of a substrate roll 40 as shown in FIG. 3 thereof.

Respectfully, the Examiner has not shown that the one of ordinary skill would be motivated to modify the teachings of Seaver et al. such that the coating and dispensing head thereof is used as an etching device.

For at least the reasons stated above, Applicants respectfully contend that Claims 34-36 are not obvious in view of the teachings of Seaver et al.

Conclusion

No other issues remaining, reconsideration and favorable action upon the Claims 1-38 now-pending in the application are requested.

Respectfully submitted,

JYOTI KIRON BHARDWAJ

By:



Adam C. Volentine
Reg. No. 33,289

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VOLENTINE FRANCOS, PLLC
12200 Sunrise Valley Drive, Suite 150
Reston, VA 20191
(703) 715-0870



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ATTACHMENT "A"

Claim Revisions – Changes Made

1. (Amended) A method of treating a substrate material or film present on the material surface comprising repeatedly performing an etching process cycle, wherein each etching process cycle increases a depth of an etched feature in the material or film, and wherein each etching process cycle includes ~~[cyclically]~~ performing the following steps:

- (a) etching the material or film to increase the depth of the etched feature;
- (b) depositing or forming a passivation layer on the surfaces of ~~[an]~~ the etched feature; and
- (c) ~~[selectively]~~ partially removing the passivation layer from the surfaces of the etched feature in order that the etching of subsequent etching process cycles proceeds in a direction substantially perpendicular to the material or film surface,

wherein at least one of steps (a) or (b) is performed in the absence of a plasma.

27. (Amended) An apparatus for treating a substrate material or film present on the material surface ~~[performing the method of Claim 1]~~, the apparatus comprising a chamber having a chemical inlet and a chemical outlet in which is positioned a support for receiving a substrate, the apparatus further comprising means for repeatedly performing an etching process cycle, wherein each etching process cycle increases a depth of an etched feature in the material or film, and wherein each etching process cycle carried out by said means includes etching a substrate material or a film present on the material surface with one or more

appropriate chemicals, ~~[means for]~~ depositing a passivation layer on the surfaces of an etched feature, and ~~[means for selectively]~~ partially removing the passivation layer from the etched feature in order that the etching of subsequent etching process cycles proceeds in direction substantially perpendicular to the material or film surface.

33. (Amended) An apparatus for treating a substrate material or film present on the material surface ~~[performing the method of Claim 1]~~, the apparatus comprising means for repeatedly performing an etching process cycle, wherein each etching process cycle increases a depth of an etched feature in the material or film, and wherein each etching process cycle carried out by said means includes etching [a] the substrate material or [a] the film present on the material surface with one or more appropriate chemicals, ~~[means for]~~ depositing a passivation layer on the surfaces of an etched feature, and ~~[means for selectively]~~ partially removing the passivation layer from the etched feature in order that the etching of subsequent etching process cycles proceeds in a direction substantially perpendicular to the material or film surface, wherein each of the ~~[means for]~~ etching, ~~[means for]~~ depositing the passivation layer and ~~[means for selectively]~~ partially removing the passivation layer are associated with the same or a separate chamber in which the substrate is positioned.

34. (Amended) A method of delivering a vapour into a chamber for etching a substrate positioned therein, the method comprising:

- (a) feeding [a] etching solution into the chamber by creating etching solution droplets on or before entering the chamber; and
- (b) generating an electrostatic field to electrostatically attract the etching solution droplets to the substrate, thereby etching the substrate.

35. (Amended) A method according to claim 34, wherein the droplets are provided with a positive or negative charge on or before entering the chamber, [preferably] created by means of a high voltage power supply connected to a droplet inlet point into the chamber, and wherein the substrate [~~then optionally being~~] is positioned on an electrode which is grounded with respect to the high voltage power supply.

37. (Amended) A vapour delivering apparatus comprising:
a dielectric [~~body~~] plate having a plurality of apertures extending therethrough from a back side of the dielectric plate to a front side of the dielectric plate [~~within which are positioned a plurality of nozzles, each nozzle extending from the back side of the body to the front side, wherein the body is metallized to form a continuous electrical path between the back side and the inside of each nozzle to the tip thereof~~]; and
a continuous metallic layer covering the back side of the dielectric plate and side walls of the plurality of apertures and terminating through each aperture at the front side of the plate, wherein plurality of apertures having the sidewalls covered by the metallic layer define a respective plurality of nozzles.